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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/881,908	06/15/2001	Soon-Bin Jung	TJK/182/ L.W.	8188
26689	7590	06/03/2004	EXAMINER	
WILDMAN, HARROLD, ALLEN & DIXON 225 WEST WACKER DRIVE CHICAGO, IL 60606			ALEJANDRO MULERO, LUZ L	
			ART UNIT	PAPER NUMBER
			1763	

DATE MAILED: 06/03/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/881,908

Applicant(s)

JUNG ET AL.

Examiner

Luz L. Alejandro

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 25 March 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-19 is/are pending in the application.
- 4a) Of the above claim(s) 1-6 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 7-19 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

**DETAILED ACTION*****Continued Examination Under 37 CFR 1.114***

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 3/25/04 has been entered.

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

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Claims 7-8, 10-16, and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Schneider et al., EP 0838841 A2 in view of Singh et al., U.S. Patent 6,042,687, Chang et al., KR 2000-053680A, and Collins et al., U.S. Patent 5,556,501.

Schneider et al. shows the invention substantially as claimed including a high density plasma processing apparatus generating a plasma, the apparatus comprising: a processing chamber providing hermetically sealed plasma generating space and having a planar surface on a top wall (see figs. 10 and 29); a gas inlet system; a plasma electrode 236 (see figs. 10 and 29, and col. 25, lines 40-42) receiving high frequency power and being installed on the planar surface of the top wall of the processing chamber; an antenna coil 180 installed on a surface of the top wall except the planar surface and receiving a second high frequency power; a means for heating the antenna coil; and a means for fixing the substrate inside the processing chamber parallel with the planar surface of the top wall of the processing chamber.

Schneider et al. does not expressly disclose: a) a plurality of gas pipes to inject the process gases, b) that the antenna includes the claimed plurality of loop-shape antennas, c) a plurality of variable capacitors connected in parallel with the plurality of antennas, and d) that a heat exchange medium is used as the means for heating the antenna coil.

Singh et al. discloses a plasma processing apparatus in which a plurality of gas pipes 160 and 172 are use to inject the gases into the processing chamber, and wherein at least one gas pipe surrounds the means for fixing the substrate in a shape of a ring and the end of the gas pipe bends toward and over the means for fixing the

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substrate so as to inject the gases upward (see fig. 3). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Schneider et al. as to comprise the claimed plurality of gas pipes in order to supply secondary gas to the processing chamber and to improve process uniformity (see col. 5, lines 15-41 of Singh et al.).

Lee et al. discloses an inductive plasma processing apparatus which comprises a concentric plurality of loop-shaped antennas comprising at least a first loop-shaped antenna having a first diameter and a second loop-shaped antenna having a second diameter greater than the first diameter, wherein the second loop-shaped antenna surrounds the first loop-shaped antenna, wherein the antennas are connected in parallel with each other, and a plurality of variable capacitors that are connected in parallel with the plurality of the antenna coils in order to maintain a resonance state therebetween (see figs. 3A, 3B). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Schneider et al. as to comprise the claimed plurality of antenna coils connected in parallel with each other and a plurality of variable capacitors that are connected in parallel with the plurality of the antenna coils in order to maintain a resonance state therebetween and maintain a constant plasma throughout the chamber.

Collins et al. discloses a plasma processing apparatus in which the antenna coil is hollow and is heated by circulating a heat exchange medium therein (see col. 21, lines 32-34). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Schneider et al. as to

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comprise antenna coils that are hollow and to circulate a heat exchange medium through the antenna coils because such structure is known and suitable for heating the antenna coil. Furthermore, with respect to claim 13, the antenna heating means of Collins et al., is capable of heating in the claimed temperature range. Concerning claim 14, note in Collins et al. that the exhaust pipe 95 is used in order to emit the heat exchanging medium outside the member and then recirculate the heat exchange medium back into the member (see col. 21-lines 15-24 and fig. 1).

With respect to claim 16, note that Schneider et al. discloses an apparatus in the form of a truncated cone (see fig. 14).

Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Schneider et al., EP 0838841 A2 in view of Singh et al., U.S. Patent 6,042,687, Chang et al., KR 2000-053680A, and Collins et al., U.S. Patent 5,556,501, as applied to claims 7-8, 10-16, and 19 above, and further in view of Hama et al., U.S. Patent 5,525,156.

Schneider et al., Singh et al., Lee et al., and Collins et al. are applied as above but do not disclose that the antenna coils are made of silver-coated aluminum. Hama et al. discloses the use of both silver and aluminum as desirable antenna coil materials (see col. 6, lines 48-50). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Schneider et al. modified by Singh et al., Lee et al., and Collins et al., as to include a silver plated aluminum antenna coil because this will produce a more resistant and cost effective

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antenna, since aluminum is an inexpensive material while silver is an expensive and highly resistant material.

Claims 17-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Schneider et al., EP 0838841 A2 in view of Singh et al., U.S. Patent 6,042,687, Chang et al., KR 2000-053680A, and Collins et al., U.S. Patent 5,556,501, as applied to claims 7-8, 10-16, and 19 above, and further in view of Fairbairn et al., U.S. Patent 5,614,055.

Schneider et al., Singh et al., Lee et al., and Collins et al. are applied as above but fail to expressly disclose wherein the means for fixing the substrate is connected to a RF power supply to receive a high frequency of 2 to 4 MHz. Fairbairn et al. discloses an RF source 90 which is applied to means for fixing a substrate and can be at a frequency of from 400kHz to 20 MHz (see col. 8-lines 42-67). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Schneider et al. modified by Singh et al., Lee et al., and Collins et al. because this is a suitable frequency to conduct inductive coupling processes.

Regarding claim 18, note that Schneider et al. discloses the application of RF power to the substrate electrode (see fig. 29).

Claims 7-8, 10-16, and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Schneider et al., EP 0838841 A2 in view of Singh et al., U.S. Patent 6,042,687, Chen et al., U.S. Patent 6,164,241, and Collins et al., U.S. Patent 5,556,501.

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Schneider et al. shows the invention substantially as claimed including a high density plasma processing apparatus generating a plasma, the apparatus comprising: a processing chamber providing hermetically sealed plasma generating space and having a planar surface on a top wall (see figs. 10 and 29); a gas inlet system; a plasma electrode 236 (see figs. 10 and 29, and col. 25, lines 40-42) receiving high frequency power and being installed on the planar surface of the top wall of the processing chamber; an antenna coil 180 installed on a surface of the top wall except the planar surface and receiving a second high frequency power; a means for heating the antenna coil; and a means for fixing the substrate inside the processing chamber parallel with the planar surface of the top wall of the processing chamber.

Schneider et al. does not expressly disclose: a) a plurality of gas pipes to inject the process gases, b) that the antenna includes the claimed plurality of loop-shape antennas, c) a plurality of variable capacitors connected in parallel with the plurality of antennas, and d) that a heat exchange medium is used as the means for heating the antenna coil.

Singh et al. discloses a plasma processing apparatus in which a plurality of gas pipes 160 and 172 are use to inject the gases into the processing chamber, and wherein at least one gas pipe surrounds the means for fixing the substrate in a shape of a ring and the end of the gas pipe bends toward and over the means for fixing the substrate so as to inject the gases upward (see fig. 3). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Schneider et al. as to comprise the claimed plurality of gas



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pipes in order to supply secondary gas to the processing chamber and to improve process uniformity (see col. 5, lines 15-41 of Singh et al.).

Chen et al. discloses an inductive plasma processing apparatus which comprises a plurality of loop-shaped antennas 300 comprising at least a first loop-shaped antenna (coil 1) having a first diameter and a second loop-shaped antenna (coil 2) having a second diameter greater than the first diameter, wherein the second loop-shaped antenna surrounds the first loop-shaped antenna, and the antennas are connected in parallel with each other, and a plurality of variable capacitors ( $C_1$  and  $C_2$ ) that are connected in parallel with the plurality of the antenna coils (see fig. 3 and its description). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Schneider et al. as to comprise the claimed plurality of antenna coils connected in parallel with each other and a plurality of variable capacitors that are connected in parallel with the plurality of the antenna coils in order to independently tailor the plasma in different regions of the chamber, therefore, providing a more uniform plasma density distribution in the chamber.

Collins et al. discloses a plasma processing apparatus in which the antenna coil is hollow and is heated by circulating a heat exchange medium therein (see col. 21, lines 32-34). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Schneider et al. as to comprise antenna coils that are hollow and to circulate a heat exchange medium through the antenna coils because such structure is known and suitable for heating the

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antenna coil. Regarding claim 13, the antenna heating means of Collins et al. is capable of heating in the claimed temperature range. Concerning claim 14, note in Collins et al. that the exhaust pipe 95 is used in order to emit the heat exchanging medium outside the member and then recirculate the heat exchange medium back into the member (see col. 21-lines 15-24 and fig. 1).

With respect to claim 16, note that Schneider et al. discloses an apparatus in the form of a truncated cone (see fig. 14).

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Schneider et al., Singh et al., Sato et al., and Collins et al. are applied as above but do not disclose that the antenna coil are made of silver-coated aluminum. Hama et al. discloses the use of both silver and aluminum as desirable antenna coil materials (see col. 6, lines 48-50). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Schneider et al. modified by Singh et al., Sato et al., and Collins et al., as to include a silver plated aluminum antenna coil because this will produce a more resistant and cost effective antenna, since aluminum is an inexpensive material while silver is an expensive and highly resistant material.

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Claims 17-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Schneider et al., EP 0838841 A2 in view of Singh et al., U.S. Patent 6,042,687, Chen et al., U.S. Patent 6,164,241, and Collins et al., U.S. Patent 5,556,501, as applied to claims 7-8, 10-16, and 18-19 above, and further in view of Fairbairn et al., U.S. Patent 5,614,055.

Schneider et al., Singh et al., Sato et al., and Collins et al. are applied as above but fail to expressly disclose wherein the means for fixing the substrate is connected to a RF power supply to receive a high frequency of 2 to 4 MHz. Fairbairn et al. discloses an RF source 90 which is applied to means for fixing a substrate and can be at a frequency of from 400kHz to 20 MHz (see col. 8-lines 42-67). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Schneider et al. modified by Singh et al., Sato et al., and Collins et al. because this is a suitable frequency to conduct inductive coupling processes.

Regarding claim 18, note that Schneider et al. discloses the application of RF power to the substrate electrode (see fig. 29).

### ***Response to Arguments***

Applicant's arguments with respect to claims 7-19 have been considered but are moot in view of the new ground(s) of rejection. Also, note that KR 2000-053680A is the foreign equivalent to U.S. Patent 6,288,493.

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**Conclusion**

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Luz L. Alejandro whose telephone number is 571-272-1430. The examiner can normally be reached on Monday to Thursday from 7:30 to 6:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Gregory L. Mills can be reached on 571-272-1439. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Luz L. Alejandro  
Primary Examiner  
Art Unit 1763

May 28, 2004